CLAIMS

I claim:

Sub B1 >

1. A method of treating an individual who has a disease or disorder associated with one or more genetic mutations or undesirable alleles in genomic DNA of the individual, or preventing an individual from developing a disease or disorder associated with one or more genetic mutations or undesirable alleles in genomic DNA of the individual, by replacing a segment of genomic DNA that has a mutated sequence or undesirable allele with a corresponding segment of DNA that has a non-mutated sequence or desirable allele, the method comprising the step of

administering to the individual an effective amount of a plurality of polynucleotide molecules that are free of vector sequences,

wherein

the plurality of polynucleotide molecules collectively comprises an essentially complete genome in polynucleotide molecules having about 100-3000 nucleotides, and

the plurality of polynucleotide molecules includes a polynucleotide molecule which comprises non-mutated sequences or desirable alleles corresponding to the genetic mutations or undesirable alleles in the genomic DNA in the individual, and

wherein

at least some of the plurality of polynucleotide molecules including polynucleotide molecules which comprises the non-mutated sequences or desirable alleles

are taken up by the cell of the individual which has the genetic mutations or undesirable alleles in genomic DNA,

are transported to the nucleus of the cell, and

recombine with the genomic DNA of the cell by homologous recombination

whereby the mutated sequences or undesirable alleles of genomic DNA is replaced by the non-mutated sequences or desirable alleles to correct the genetic mutation in the genomic DNA or incorporate the desirable allele into the genomic DNA.

2. The method of claim 1 wherein the individual who has a disease or disorder associated with one or more genetic mutations in genomic DNA of the individual and is treated by replacing one or more segments of genomic DNA that have mutated sequences with corresponding segments of DNA that have a non-mutated sequences.

3. The method of claim 2 wherein the individual who has a disease or disorder associated with one or more genetic mutation in genomic DNA of the individual selected from the group consisting of: cancer; heart and blood vessel diseases; peripheral blood vessel diseases; autoimmune diseases; diabetic conditions; neurodegenerative conditions; gastroenterological and hepatological diseases; mutagenic pathogen disorders; classic hereditary diseases; disorders due to exposure to mutagenic stimuli; aging and other multifactorial diseases.

4. The method of claim 1 wherein the individual who has a disease or disorder associated with one or more undesirable alleles in genomic DNA of a cell of the individual and is treated by replacing one or more segments of genomic DNA that have the undesirable alleles with corresponding segments of DNA that have desirable alleles.

5. The method of claim 1 wherein the plurality of polynucleotide molecules are administered by a route of administration selected from the group consisting of: intravenous injection; intramuscular injection; intradermal injection; subcutaneous delivery; intraperatoneal delivery; topical delivery to mucosa and/or skin, delivery by lavage to mucosa and/or skin; ingestion per os; per rectum; intravaginally; intraocularly; intranasally, intratumorally; intracerebrally, intraocular injection, by inhalation and by delivery to the spinal cord.

6. The method of claim 1 wherein the plurality of polynucleotide molecules are administered by a regimen selected from the group consisting of: single dose, continuous infusion, multiple doses administered hourly, multiple doses administered daily, multiple doses administered every other day, multiple doses administered weekly.

7. The method of claim 1 wherein the plurality of polynucleotide molecules are administered in an amount of 0.01 – 16 g of polynucleotides having 200-3000 nucleoitides each.

8. The method of claim 7 wherein the plurality of polynucleotide molecules are administered in an amount of 0.01 – 16 g of polynucleotides having 200-3000 nucleotides each with an average length of 300 -1000 nucleotides.

9. The method of claim 8 wherein the plurality of polynucleotide molecules are administered in an amount of 0.01 – 16 g of polynucleotides having 200-3000 nucleotides each with an average length of 500 nucleotides.

10. The method of claim 1 wherein the plurality of polynucleotide molecules are administered in an amount of 0.04 – 16 g of polynucleotides having 200-3000 nucleotides each.

11. The method of claim 10 wherein the plurality of polynucleotide molecules are administered in an amount of 0.4 – 16 g of polynucleotides having 200-3000 nucleotides each.

12. The method of claim 1 wherein the plurality of polynucleotide molecules are DNA manufactured by amplifying DNA from donor genomic DNA using PCR with degenerative primers.

13. The method of claim 1 wherein the plurality of polynucleotide molecules are derived from autologous DNA collected at the patient's young age or at least before the disease or exposure to irradiation or chemical mutagens.

14. The method of claim 1 wherein the plurality of polynucleotide molecules are free DNA.

15. The method of claim 1 wherein the plurality of polynucleotide molecules are DNA in complexes with histones, polyamines or synthetic polycations.

Sub B1 16. The method of claim 1 wherein at least 80% of polynucleotide molecule administered are about 200-3000 nucleotides in length.

17. The method of claim 16 wherein at least 80% of polynucleotide molecule administered are about 200-3000 nucleotides in length and have an average length of about 300-1000.

18. The method of claim 17 wherein at least 80% of polynucleotide molecule administered are about 200-3000 nucleotides in length and have an average length of about 500.

19. The method of claim 16 wherein at least 80% of polynucleotide molecule administered are about 300-2000 nucleotides in length.

20. The method of claim 19 wherein at least 80% of polynucleotide molecule administered are about 300-2000 nucleotides in length and have an average length of about 500.

21. The method of claim 19 wherein at least 80% of polynucleotide molecule administered are 300-1000 nucleotides in length.

22. The method of claim 21 wherein at least 80% of polynucleotide molecule administered are 300-1000 nucleotides in length and have an average length of 500.

23. A method of inducing tolerance and preventing transplant rejection in a recipient comprising the steps of

administering to the recipient an effective amount of a plurality of polynucleotide molecules that are free of vector sequences,

wherein

the plurality of polynucleotide molecules collectively comprises an essentially complete genome of the donor in polynucleotide molecules having about 100-3000 nucleotides, and

wherein

at least some of the plurality of polynucleotide molecules

are taken up by the cell of the recipient,

are transported to the nucleus of the cell, and

recombine with the genomic DNA of the cell by homologous recombination

whereby genomic DNA of the recipient is replaced by genomic DNA of the donor and tolerance is induced and transplant rejection is reduced in the individual.

24. A method of increasing fertility in a woman comprising the steps of

administering to the woman an effective amount of a plurality of polynucleotide molecules that are free of vector sequences,

wherein

the plurality of polynucleotide molecules collectively comprises an essentially complete genome of a prospective father in polynucleotide molecules having about 100-3000 nucleotides, and

wherein

at least some of the plurality of polynucleotide molecules

are taken up by cells of the woman,

are transported to the nucleus of the cell, and

recombine with the genomic DNA of the cell by homologous recombination

whereby genomic DNA of the woman is replaced by genomic DNA of the prospective father and fertility is improved in the woman.

25. An apparatus for doing large scale PCR preparations comprising:

a) a reaction tube having an inner diameter of at least 3 mm;

b) at least one pump for continuously supplying of reagents to the reaction tube;

c) four temperature chambers; and

d) a collection vessel

wherein reagents are combined and enter the reaction tube by action of the pump, wherein the reaction tube comprises a series of reaction tube lengths which alternately pass through each of the four temperature chambers to produce a cycle segment, such that a length of the reaction tube passes through the first temperature chamber, a length of the reaction tube passes through the second temperature chamber, a length of the reaction tube passes through the third first temperature chamber, a length of the reaction tube passes through the fourth temperature chamber to produce a cycle segment, wherein the reaction tube comprises at least twenty consecutive cycle segments, the reaction tube being connected to the collection vessel following the last cycle segment.

26. The apparatus of claim 25 wherein the reaction tube has an inner diameter of 4 mm - 20 mm.

27. A pharmacuetical composition that comprises, in a pharaceutically acceptable carrier, a plurality of polynucleotide molecules which collectively comprise an essentially complete genome in polynucleotide molecules having about 100-3000 nucleotides.

28. The pharmacuetical composition of claim 27 having 0.01 – 16 g of polynucleotides having 200-3000 nucleotides each.

29. The pharmacuetical composition of claim 27 wherein at least 80% of polynucleotide molecules are about 200-3000 nucleotides in length.

30. The pharmacuetical composition of claim 27 wherein said pharmaceutical composition is sterile and pyrogen free.